

A REVISION OF THE PERENNIAL SPECIES OF
GERANIUM OF THE UNITED STATES
AND CANADA

G. NEVILLE JONES AND FLORENCE FREEMAN JONES

(Continued from page 26)

7. *G. RICHARDSONII* Fisch. & Trautv. Perennial, the usually simple caudex covered with brownish marcescent scale-like leaf-bases and stipules; stems solitary or few, erect, 30–90 cm. tall, glabrous or sparsely pubescent; petioles of the basal leaves 5–20 (rarely 30) cm. long, glabrous or sparsely retrorsely strigose or pilose; blades 3–15 cm. broad, usually pentagonal in outline, deeply 5–7-parted, the rhombic segments several times lobed, lanceolate or ovate, acute or acuminate, sparsely strigose on the upper surface, and along the principal veins on the lower surface; cauline leaves 3–5-parted, sparsely strigose, with sharply incised and tapering lobes, or occasionally the uppermost lanceolate and serrate but not lobed; stipules lanceolate, attenuate, 6–12 mm. long, ciliolate, puberulent, or glabrous; inflorescence spreading-cymose, the peduncles 2–12 cm. long, glandular-pilose, with translucent trichomes 0.5–1 mm. long, tipped with purple glands; pedicels slender, 1–2 cm. long, paired, becoming reflexed and bent upward in fruit, rather copiously glandular-villosulous with straight, mostly purple-tipped trichomes; sepals 6–12 mm. long, lanceolate or narrowly oval, the outer ones more or less glandular-pubescent, at least toward the base or near the margins; mucro 1.5–2.5 mm. long; petals 10–18 mm. long, obovate, obtuse, entire, milk-white, or sometimes pink-tinted, usually with purple or pink veins, pilose inside for about one-half their length; filaments reddish purple, short-pilose three-fourths their length; mature stylar column 2–2.5 cm. long, glandular-villosulous, and with a shorter non-glandular pubescence; stylodia yellowish green, 3–5 mm. long; carpel-bodies 2.5–4 mm. long, sparingly pubescent and with scattered stiff hairs, hispid or glandular-hispid along the keel, the trichomes less than 1 mm. long; seeds 2.5–3.5 mm. long, coarsely reticulate.—Ind. Sem. Hort. Petrop. iv. 37 (1837); Gray, *Plantae Fendl.* [Mem. Am. Acad. ser. 2. iv.] 25. (1849); Engelm. in Gray, *Mem. Am. Acad. n. s.* iv. 27 (1849); Brewer & Watson in *Bot. Calif.* i. 94 (1880); Macoun, *Cat. Can. Pl.* i. 90 (1883); Trelease in *Mem. Boston Soc. Nat. Hist.* iv. 75 (1888); Coville in *Contr. U. S. Nat. Herb.* iv. 76 (1893); Trelease in Gray, *Syn. Fl.* i. 359 (1897); Howell, *Fl. Nw. Am.* 106 (1897); Rydberg in *Mem. N. Y. Bot. Gard.* i. 265 (1900); Hanks & Small in *N. Am. Fl.* xxv. 18 (1907); Coulter & Nelson, *New Man. Rocky Mt. Bot.* 303 (1909); Knuth in Engler, *Pflanzenr.* iv (129). 114 (1912); Hall & Hall, *Yosemite Fl.* 149 (1912); Wootton & Stand-

ley, Contr. U. S. Nat. Herb. xix. 380 (1915); Henry, Fl. So. Brit. Columbia, 198 (1915); Rydberg, Fl. Rocky Mts. 531 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925); Jepson, Man. Fl. Pl. Calif. 590, t. 584 (1925); Rydberg, Fl. Prairies & Plains, 501 (1932); Raup in Contrib. Arnold Arb. vi. 182 (1934); Munz, Man. So. Calif. Bot. 274, t. 143 (1935); Jepson, Fl. Calif. ii. 405 (1936); E. H. Graham, Ann. Carnegie Mus. xxvi. 259 (1937); Peck, Man. Higher Pl. Oregon, 462 (1941); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). *Geranium albiflorum* sensu Hooker, Fl. Bor.-Am. i. 116, t. 40 (1830), in Curtis' Bot. Mag. lix. t. 3124 (1832); Torr. & Gray, Fl. N. Am. i. 206 (1838). Non Ledeb. Icon. Pl. Fl. Ross. i. 6, t. 18 (1829), and Fl. Altaica, iii. 230 (1831). *Geranium Hookerianum* Walpers, Rep. Bot. Syst. i. 450 (1842). *Geranium pentagynum* Engelman in Wislizenus, Mem. Northern Mexico, 90 (1848) and in Gray, Mem. Am. Acad. n. s., iv. 27 (1849). *Geranium gracilentum* Greene in Rydberg, Colorado Exp. Sta. Bull. c. 218 (1906). *Geranium loloense* St. John, Fl. Se. Wash. & Adj. Idaho 242 (1937).—Moist open woods and thickets, along creeks, in wet meadows, and springy places on hillsides; common from British Columbia and Saskatchewan southward to South Dakota, New Mexico, and California.—TYPE LOCALITY: "Vallies in the Rocky Mountains. Drummond," between latitudes 52° N. and 54° N.—Representative specimens: BRITISH COLUMBIA: Klappan River, Preble & Mixer 636 (US); Horsethief Creek, Titus Ulke 1253 (NY); along Wicked River, near the Peace, Raup & Abbe 3824 (NY, G); North Fork Illecillewaet, J. M. Macmillian 565 (NY, G); Mt. Selwyn, Raup & Abbe 3791 (G). IDAHO: Musselshell Creek, Lolo Trail, Bitter Root Mts., C. V. Piper 4027 (NY, isotype of *G. loloense* St. John); Henry Lake, Fremont Co., E. B. & Lois B. Payson 1948 (G); Caribou Mountain, Bonneville Co., Payson & Armstrong 3523 (G, UI); Lochas River, Idaho Co., Constance & Rollins 1677 (G). UTAH: Big Cottonwood Canyon, Salt Lake Co., A. O. Garrett 1520 (NY, G), Rydberg & Carlton 6488 (NY); Hammond Canyon, Elk Mts., Rydberg & Garrett 9578 (NY); Western Bear's Ear, Elk Mts., Rydberg & Garrett 9350 (NY, G); Gold Basin, La Sal Mts., Rydberg & Garrett 9073, 9074 (NY); La Sal Mts., San Juan Co., H. C. Cutler 2701 (NY), E. B. & Lois B. Payson 4093 (G, UC); Uintah Mts., L. N. Goodding 1317 (G); Chain Lakes Trail, Duchesne Co., F. J. Hermann 5241 (G); Alta, Wasatch Mts., M. E. Jones 1173 (NY, F); Abajo Mts., Goodman & Hitchcock 1450 (NY), 1452 (NY, UC, G); Bear River, Summit Co., G. J. Goodman 1874 (NY, G); Red Banks, A. Isabel Mulford 234 (NY); Fish Creek Canyon, Sevier Co., A. O. Garrett 2550 (NY). NEVADA: Lake Tahoe, D. R. Goddard 1055 (UC); CALIFORNIA: Donner Lake, Nevada Co., C. F. Sonne 43 (NY, UI, F), A. A. Heller 6997 (NY, UC, G);

Tulare Co., *Culbertson* 4382 (NY, UC, F, G); Echo Lake, El Dorado Co., *A. A. Heller* 13348 (NY, G, F, UI); Dry Lake Canyon, San Geronimo Mts., San Bernardino Co., *Abrams & McGregor* 790 (NY, G); Bear Valley, San Bernardino Mts., *Leroy Abrams* 2831 (NY, G); Bluff Lake, San Bernardino Co., *S. B. Parish* 3784 (G), *I. W. Clokey* 5274 (NY, UC, G); Yosemite National Park, *H. M. Evans*, July 12, 1921 (F); Mill Creek Falls, San Bernardino Co., *S. B. Parish* 5065 (NY); San Bernardino, *W. G. Wright* in 1880 (G); Tioga Road near White Wolf, Sierra Nevada, *F. J. Smiley* 885 (G); Mono Lake, *W. H. Brewer* 1812 (G). ARIZONA: Grand Canyon of the Colorado, *T. F. Allen*, Aug. 1897 (NY); White Mts., Apache Co., *L. N. Goodding* 569 (NY, G), 1197 (NY); 45 mi. n. of Clifton, White Mts., *Kearney & Peebles* 12258 (NY); San Francisco Mt., *J. W. Toumey*, Sept. 10, 1894 (NY), *Cannon & Lloyd*, Aug. 1904 (NY); Rincon Mts., *J. C. Blumer* 3372 (G, UC). ALBERTA: Calgary, *Marion E. Moody* 1054 (NY, G, F, UC), 45 (NY, F); *M. A. Barber* 197 (G); Banff, *Butters & Holway* 89 (G); Lake Louise, *F. W. Hunnewell* 4230 (G). SASKATCHEWAN: *E. Bourgeau* in 1858 (NY, G); Farewell Creek, *John Macoun* 10082 (NY); Cypress Hills, *John Macoun* 74 (F). MONTANA: Glacier National Park, *G. Neville Jones* 5478 (NY, G); Cutbank Creek, Glacier National Park, *C. L. Hitchcock* 2013 (G); Lewis & Clark Forest, *J. E. Kirkwood* 2310 (G); Jones Canyon, Gallatin Co., *E. J. Moore*, July 28, 1900 (G); Sedan, Gallatin Co., *B. J. Jones*, July 28, 1901 (G); Terminus Canyon, *S. Watson* 68 (G); Wilsall, Park Co., *W. N. Suksdorf* 7 (G); Helena, *B. T. Butler*, 778 (NY); Midvale, *L. M. Umbach* 171a (F); Tobacco Mts., *B. T. Butler* 4232 (NY); Little Belt Mts., *J. H. Flodman* 654 (NY); Jack Creek Canyon, *Rydberg & Bessey* 4516 (NY); Big Belt Mts., *J. W. Blankinship*, Aug. 14, 1899 (NY); Summit, *R. S. Williams*, July 25, 1894 (NY). SOUTH DAKOTA: Lower Elk Canyon, *A. C. McIntosh* 1278 (NY); Elk Canyon, *Rydberg* 583 (NY); Elk Creek, Nemo, *G. Neville & Florence Freeman Jones* 14854 (UI); North Rapid Creek Ranger Station, *J. Murdoch* 3003 (NY, F, G); Rapid City, *T. A. Williams* 364 (NY); Spearfish Canyon, *H. E. Hayward* 138 (NY, F); Deadwood, *W. P. Carr* 168 (F, G), *E. J. Palmer* 37063 (G); Boulder Canyon near Sturgis, *G. Neville & Florence Freeman Jones* 14844 (UI). WYOMING: Sheridan Co., *L. O. & Rua Williams* 3206 (NY, G); between Sheridan & Buffalo, *F. Tweedy* 3645 (NY); Battle, Carbon Co., *F. Tweedy* 4594 (NY); Fish Creek, Teton Forest Reserve, *F. Tweedy* 495 (NY); Yellowstone National Park, *F. Tweedy* 232 (NY), *C. H. Hall*, June 1888 (NY), Obsidian Creek, *Aven & Elias Nelson* 6084 (NY, G); *G. Neville & Florence Freeman Jones* 14808 (UI); Shoshone National Forest, Park Co., *L. O. & Rua Williams* 3512 (NY, G); near Centennial, Albany Co., *R. C. Rollins* 935 (NY), *G. Neville & Florence Freeman Jones* 14607

(UI); Antelope Basin, Albany Co., *Aven Nelson* 7491 (NY, G); Pole Creek, *Aven Nelson* 1403 (NY); Shell Canyon, Big Horn Mts., *G. Neville & Florence Freeman Jones* 14827 (UI); Paint-rock Creek, Big Horn Mts., *J. G. Jack*, Aug. 4, 1900 (G); Fremont Lake, Sublette Co., *E. B. & Lois B. Payson*, 2858 (G, F, UC); Leckie, *Merrill & Wilcox* 534 (G); Camp Crawford, *Mrs. Joseph Clemens*, Aug. 6, 1908 (G); Willow Creek, *Elias Nelson* 95 (NY), 3369 (F). COLORADO: Headwaters of Clear Creek, east of Middle Park, *C. C. Parry* 112 (NY, G); Four-mile Hill, Routt Co., *C. F. Baker*, July 22, 1896 (NY); Columbine, *F. Tweedy* 4592 (NY); Rio Blanco Creek, Archuleta Co., *R. C. Rollins* 1542 (NY, UI); La Veta, Huerfano Co., *R. C. Rollins* 1285 (NY, G); Lake Brennan, Gunnison Co., *R. C. Rollins* 1455 (NY, G, UI); Mount Carbon, Gunnison Co., *W. W. Eggleston* 5802 (G); So. Park, *Miss E. L. Hughes* 14 (G); La Plata, *Baker, Earle & Tracy* 673 (NY, F, G); Mancos, *Baker, Earle & Tracy* 44 (NY, F, UC, G); Piedra, *C. F. Baker* 449 (G, NY, UC, F, type collection of *G. gracilentum* Greene); Bob Creek, La Plata Mts., *Baker, Earle & Tracy* 195 (NY, F); North Park Range, Routt Co., *L. N. Goodding* 1796 (NY, G); Artist's Glen, Pike's Peak, *H. M. Hall* 10928 (G, UC); Golden City, *E. L. Greene* 62 (G); Georgetown, *M. E. Jones* 836 (NY); Colorado Territory, *C. C. Parry* in 1872 (NY); Twin Lakes, *I. W. Clokey* 3529 (NY, UI, F); Tolland, *L. O. Overholts*, July 3, 1914 (NY); Ouray, *Underwood & Selby* 19,130 (NY); near Lyons, *E. L. Johnston* 694 (G); Fraser, *Johnston & Hedgecock* 678 (G, UC); Wolf Creek Pass, San Juan Mts., Mineral Co., *C. B. Wolf* 3038 (G); Manitou, *M. A. Carleton* 418 (UI); Bosworth's Ranch, *C. S. Crandall* 1147 (G, UI); St. Elmo, Chaffee Co., *R. C. Rollins* 1380 (NY, UI); Pine River, *Mrs. F. Stone* 507 (NY). NEW MEXICO: Ute Park, Colfax Co., *P. C. Standley* 14410 (G, F); Mogollon Mts., Catron Co., *C. B. Wolf* 2635 (G); *H. H. Rusby* 59 (NY, F); Santa Fé, *A. A. & E. Gertrude Heller* 3643 (NY, F, G, UI); Cloudcroft, Sacramento Mts., Otero Co., *E. O. Wooton*, July 18, 1899 (NY); White Mountains, Lincoln Co., *E. O. Wooton* 302 (NY, UI, UC); Middle Fork of the Gila, Mogollon Mts., Socorro Co., *E. O. Wooton*, Aug. 5, 1900 (NY); Redstone, *A. Isabel Mulford* 868 (NY, UI); *A. Fendler* 88 (NY, F, G); Pecos River National Forest, *P. C. Standley* 4013, 4563 (NY, G).

Geranium Richardsonii was first described by Sir William Jackson Hooker as *G. albiflorum* on the basis of specimens collected by Thomas Drummond in the Rocky Mountains of Canada. Hooker's name, published in the *Flora Boreali-Americana* in 1830¹, unfortunately had been antedated by *G. albiflorum*

¹ See B. Daydon Jackson, Bibliographical Notes, in Bull. Herb. Boissier i. 298 (1893) for verification of this date.

Ledeb.¹, an Asiatic species, in 1829. This necessitated the new name *G. Richardsonii* Fisch. & Trautv. for the western North American white-flowered plant. *Geranium Richardsonii* has the most extensive range of any North American species of this genus. It extends from northern British Columbia to New Mexico and California. It has been reported from Cumbre Trojes, District of Temascaltepec, Mexico, by A. A. Bullock (Kew Bulletin 1937: 504. 1938). This is apparently a new southern record. It shows small variations, such as differences of size of flowers and leaves, slenderness of habit, and quantity of indument on various parts of the plant. In alpine situations in the southern part of its range the plants are often much smaller and are frequently cespitose. None of these slight variations appears to have any nameworthy taxonomic significance. The petals are almost always milk-white with pink or purple veins, occasionally varying to pinkish or rose.

The name *G. gracilentum* Greene has been relegated to synonymy under *G. Richardsonii*. The circumstances of the original publication of *G. gracilentum* were rather peculiar. The name was first published in 1906 in Rydberg's *Flora of Colorado*, but no description was given, and the few characters cited were merely part of the key. Eleven years later, Rydberg (1917) put *G. gracilentum* into synonymy under *G. Richardsonii*. In the *Flora of Colorado* the only character relied upon to distinguish *G. gracilentum* from *G. Richardsonii* is the appressed pubescence of the lower part of the stem, the statement in the key being that *G. Richardsonii* has a glabrous stem.

Examination of a series of specimens shows conclusively that *G. loloense* St. John is clearly identical with the common, widely distributed, white-flowered, western North American *G. Richardsonii*. In discussing the relationship of *G. loloense*, St. John compared it with *G. nervosum* Rydb. [i. e., *G. strigosius*], and pointed out several quantitative differences, but apparently overlooked the fact that Rydberg in 1901 had already outlined a similar segregation of species when he separated "*G. nervosum*" from *G. Richardsonii*.

8. *G. concinnum* sp. nov. Perennis, caudice lignoso saepius singulo foliorum basibus stipulisque marcescentibus squamato;

¹ Ledebour, C. F., *Icones Plant. Ross.* i. 6, t. 18 (1829).

caulibus singulis vel paucis, erectis, gracilibus, minute retrorso-pubescentibus vel subglabris, 10–50 cm. longis; foliis basalibus subrosulatis, petiolo 8–20 cm. longo, minute retrorso-pubescente vel subglabro; lamina 2–7 cm. lata, reniformi vel pentagona, profunde 5–7-partita, laciniis rhombeis profunde incisus, lobis lanceolatis vel ovalibus utrinque minute adpresseque pubescentibus; foliis caulinis paucis, minoribus, brevius petiolatis caeterum cum basalibus congruentibus; stipulis lanceolatis, puberulis, 4–7 mm. longis; inflorescentia terminali, laxa, gracili, pedunculis saepius facie scaposis, 5–11 cm. longis, minute glanduloso-puberulis, pedicellis 2-jugis, 2.5–11 cm. longis, sub fructu erectis, sat conferte brevi-glandulosis trichomatibus glandulosis luteis vel translucentibus ornatis; sepalis 6–8 mm. longis, ovatis vel lanceolatis, mucrone 1.5–2 mm. longo; petalis 10–15 cm. longis, anguste obovatis, obtusis, integris, pallide violaceis vel roseis, intus ad medium vel tertium superum pilosis; filamentis ad tertium inferum ciliatis; columna stylari evoluta 2–2.5 cm. longa, glanduloso-puberula; stylodiis 4–5 mm. longis; carpidiis 4–5 mm. longis, pubescentibus, secus dorsum glandulosis; seminibus ca. 3 mm. longis, minute reticulatis.

Perennial, the woody, usually simple caudex covered with brownish marcescent scale-like leaf-bases and stipules; stems solitary or few, erect, slender, finely retrorsely pubescent to nearly glabrous, 10–50 cm. tall; basal leaves somewhat tufted, the petioles 8–20 cm. long, finely retrorsely pubescent to nearly glabrous; blades 2–7 cm. broad, reniform to pentagonal, deeply 5–7-parted, the segments rhombic, deeply incised with lanceolate to oval lobes, finely appressed-pubescent on both surfaces; cauline leaves few, smaller, shorter-petioled, but of similar texture and indument; stipules lanceolate, puberulent, 4–7 mm. long; inflorescence terminal, lax, slender, the peduncles often scape-like, 5–11 cm. long, finely glandular-puberulent; pedicels paired, 2.5–11 cm. long, erect in fruit, rather densely short-glandular, the trichomes tipped with yellowish or translucent glands; sepals 6–8 mm. long, oval or lanceolate, the mucro 1.5–2 mm. long; petals 10–15 mm. long, narrowly obovate, obtuse, entire, pale lavender to pink, pilose inside one-half to three-fourths their length; filaments ciliate one-third their length; mature stylar column 2–2.5 cm. long, glandular-puberulent; stylodia 4–5 mm. long; carpel-bodies 4–5 mm. long, pubescent, glandular along the keel; seeds about 3 mm. long, minutely reticulate.—TYPE LOCALITY: Kern River, Tulare Co., California. A montane species occurring at altitudes of 7000–8000 feet in central and southern California. Specimens examined: CALIFORNIA: Kern River, *Culbertson* 4454 (G, TYPE; NY, UC); Bear Valley, San Bernardino Co., *S. B. Parish* 1806 (G, F, UC); Frazier Mt., *Dudley & Lamb* 4536 (UC), *H. M. Hall* 6602 (UC);

Olancha Mountain, Tulare Co., *Hall & Babcock* 5225 (UC); Eagle Creek, Mono Co., *T. M. Hendrix* 349 (UC).

Geranium concinnum is undoubtedly closely related to *G. Richardsonii* on the one hand and to *G. californicum* on the other, constituting in certain respects an entity somewhat intermediate between those two species. It differs from *G. Richardsonii* in its pale lavender or pink petals, its longer stylodia, and in having the trichomes of the pedicels tipped with yellowish or translucent glands. From *G. californicum* it differs in its shorter stylodia, and the puberulence of the stem, petioles, and blades. Apparently it bears about the same relationship to *G. californicum* as does *G. viscosissimum* to *G. strigosius*, or *G. eremophilum* to *G. caespitosum*.

It is apparent that *G. Richardsonii*, *G. concinnum*, and *G. californicum* constitute three closely related species that are distinguished by small but rather definite morphological characters. Their phytogeography and ecological relationships are as yet not too well defined. Further study in the herbarium and especially in the field will be necessary before this perplexing group of species will have been elucidated to the full satisfaction of Californian botanists.

We are giving this plant the specific name *concinnum* on account of its neat and delicate appearance.

9. *G. californicum*, nom. nov. Perennial with a stout, elongate, woody caudex; stems solitary or 2 or 3 and more or less tufted, erect or spreading, 20–70 cm. long, sparsely villous, the scattered trichomes on the lower part of the stem 1–2 mm. in length; upper part of stem sparsely pilose, and with scattered short glandular trichomes; petioles of the basal leaves 5–25 cm. long, sparsely villous; blades 3–8 cm. broad, thin, orbicular to pentagonal in outline, usually 5-parted, the divisions cuneate or rhombic with the smaller lobes acute; upper surface finely strigose, paler and rather copiously hirsute beneath especially along the somewhat prominent veins; cauline leaves similar but smaller; stipules lanceolate, 6–12 mm. long, puberulent or more or less pilose; inflorescence axillary or terminal, sometimes arising directly from the caudex; pedicels in pairs, or sometimes in threes, 1–12 cm. long, copiously yellowish glandular-villosulous and with longer glandless trichomes; sepals oval, 3-veined, thin-margined, 6–9 mm. long, pilose, a few of the hairs gland-tipped; mucro 1.5–2 mm. long; petals narrowly obovate, obtuse, entire, 12–16 mm. long, rose-pink or white, with dark veins, pilose about

half their length; filaments sparsely pilose about one-fourth to one-half their length; mature stylar column 2–2.5 cm. long, rather copiously glandular-villosulous; stylodia 6–9 mm. long; carpel-bodies about 4–5 mm. long, sparsely glandular-hirsute; seeds about 3 mm. long, faintly reticulate.—*Geranium incisum* sensu Brewer & Watson, Bot. Calif. i. 94 (1880), ex p.; Hall & Hall, Yosemite Fl. 148 (1912). Non Andrews (1799), nec Nutt. ex Torr. & Gray (1838). *Geranium leucanthum* Small in N. Am. Fl. xxv. 18 (1907); Knuth in Engler, Pflanzenr. iv (129). 116 (1912); Munz, Man. So. Calif. Bot. 275 (1935), ex p. Non Grisebach in Goett. Abh. xix. 103 (1874), nec Andr. ex Trautv. in Act. Hort. Petrop. viii. 177 (1883), nom. nud. *Geranium caespitosum* sensu Jepson, Man. Fl. Pl. Calif. 590 (1925), Fl. Calif. ii. 404 (1936), ex p. Non James apud Gray, 1849.—Meadows and open forests, 4000–8000 feet altitude, middle and southern California.—TYPE LOCALITY: Pineridge, Fresno Co., California.—Specimens examined: CALIFORNIA: Pineridge, Fresno Co., Hall & Chandler 224 (NY, TYPE of *G. leucanthum* Small; UC); San Bernardino Mts., Yosemite Valley, J. B. Lumbert, June 1894 (NY); San Jacinto Mts., H. E. Hasse, July 2, 1892 (NY); Mariposa Co., A. Wood in 1866 (NY); Yosemite Valley, John Torrey, in 1872 (NY), LeRoy Abrams 4386 (NY, G, UC), W. H. Brewer 1674 (G), H. M. Hall 9234 (UC); Sierra National Forest, LeRoy Abrams 4982 (NY, G); Sierra Nevada Mts., Fresno Co., F. J. Smiley 590 (G); Mather, Tuolumne Co., H. L. Mason 2139 (G, UC), H. M. Hall 11813, 11814 (UC); Tuolumne Co., E. R. Drew, July 3, 1887 (UC); North Fork, Madera Co., R. Bacigalupi 2272 (UC); Stanislaus National Forest, Tuolumne Co., I. L. Wiggins 6810 (UC); Salmon Creek, Tulare Co., Hall & Babcock 5147 (UC); Greenhorn Range, Kern Co., Hall & Babcock 5048 (UC).

This species has been mistaken for the Rocky Mountain *G. caespitosum*, and for *G. strigosius* [i. e., *G. incisum* of authors], a species which enters California only in the extreme northern part. It has also been called *G. Richardsonii*. In 1907, Small recognized its distinctness from that white-flowered species, giving it the name *G. leucanthum* in allusion to its pale flowers which were erroneously said to be white. Small's name cannot be maintained because that binomial was published by Grisebach in 1874 for a plant of Argentina. We are therefore renaming this species for California, where it is endemic.

Hall & Hall (1912, p. 148) published the following field-notes about this species, which they referred to as *G. incisum*: "This pink-flowered geranium, which grows from thick, perennial

roots, is a pleasing and not uncommon inhabitant of the Yellow Pine Belt. In exposed places the plants are small and very hairy, in the shade they become taller and smoother. Occasionally they produce albino flowers and can then scarcely be distinguished from the next species." [i. e., *G. Richardsonii*].

10. GERANIUM **attenuilobum**, sp. nov. Perennis, caudice ut videtur simplici; cauli solitario, erecto conferte glanduloso-puberulo; foliis basalibus ignotis, caulinarum petiolo glanduloso, lamina 2.5–6 cm. lata, supra pilosula, pallidiore, subtus secus venas glandulosa, 5-partita, laciniis irregulariter 3-lobis, lobis lanceolatis, acuminatis, lobulo mediano segmenti cujusvis quam caeteris longiore abrupte attenuato vel caudato, cauda 4–6 mm. longa; stipulis lanceolatis, 5–15 mm. longis, dense puberulis, ciliatis; inflorescentia terminali; pedunculis 3–9 cm. longis, glanduloso-puberulis, pedicellis 1–5 cm. longis, sat conferte glanduloso-villosulis, primum reflexis dein sub fructu erectis; sepalis ovalibus, 8–11 mm. longis, glanduloso-pubescentibus, mucrone 2.5–3 mm. longo; petalis obovatis, apice retusis, 12–16 mm. longis, saturate roseis ad medium pilosis; filamentis ad medium vel ad tertium superum pilosis; stylodiis 5 mm. longis; columna stylari evoluta 2.5–3.5 cm. longa, sat conferte glanduloso-pubescente; carpidiis maturis seminibusque haud visis.

Perennial with (probably) a simple caudex; stem solitary, erect, densely glandular-puberulent; basal leaves not seen; petioles of the cauline leaves glandular, blades 2.5–6 cm. broad, pilosulous above, paler and glandular along the veins beneath, 5-parted, the divisions unequally 3-lobed, each lobe lanceolate, acuminate, the middle lobe of each segment longer than the others and abruptly attenuate or caudate, the caudate tips 4–6 mm. long; stipules lanceolate, 5–15 mm. long, densely puberulent, ciliate; inflorescence terminal; peduncles 3–9 cm. long, glandular-puberulent; pedicels 1–5 cm. long, rather copiously glandular-villosulous, reflexed and bent upward in fruit; sepals oval, 8–11 mm. long, glandular-pubescent, the mucro 2.5–3 mm. long; petals obovate, retuse at the apex, 12–16 mm. long, rose-purple, pilose one-half their length; filaments pilose one-half to two-thirds their length; stylodia 5 mm. long; mature stylar column 2.5–3.5 cm. long, rather copiously glandular-pubescent; mature carpels and seeds not seen.—In mountain valleys of Modoc Co., California. TYPE LOCALITY: Jess Valley, Warner Mountains, Modoc Co., California. Specimens examined: CALIFORNIA: Jess Valley, Warner Mountains, Modoc Co., July 24, 1925 *F. H. Frost* 113 (G, TYPE; UC).

This species differs from the other large-flowered North American geraniums by the unique attenuation of the leaf-lobes.

Its loose inflorescence with the several-flowered peduncles points to a probable alliance with *G. strigosius*, but its abundantly pilose petals indicate also a possible affinity with *G. californicum*. We have seen only one collection of *G. attenuilobum*. This consists of the inflorescence and the upper part of the stem. We are giving this plant the specific name *attenuilobum* in allusion to the distinctive attenuate lobing of the upper leaves.

11. *G. MARGINALE* Rydb. Perennial with branched caudex; stems 10–40 cm. tall, erect or ascending, finely retrorsely pubescent; petioles of the basal leaves 8–18 cm. long, puberulent or finely pubescent; blades 2–3.5 cm. broad, reniform to pentagonal, strigillose or puberulent on both surfaces, 5-parted, the divisions rhombic to obovate, 3-toothed near the apex, the ultimate lobes lanceolate or ovate, acute, with acute sinuses; cauline leaves similar, but usually smaller; stipules triangular-lanceolate, 2–7 mm. long, puberulent, ciliolate; inflorescence cymose, spreading, terminal; peduncles 1–3.5 cm. long; pedicels 1–3 cm. long, more or less retrorsely puberulent with non-glandular trichomes; petals narrowly oblanceolate or narrowly obovate, obtuse, entire, 10–12 mm. long, pale pink or lavender, pubescent within about one-fourth their length or less, otherwise glabrous; sepals 7–9 mm. long, oval to shortly lanceolate, puberulent to nearly glabrous, narrowly hyaline-margined, 3-veined, the mucro 1–2 mm. long; filaments ciliate one-third their length; mature stylar column puberulent to shortly pilosulous, non-glandular, 1.5–2 cm. long; stylodia 3–4 mm. long; carpel-bodies 4 mm. long; seeds 3 mm. long, faintly reticulate.—Rydberg ex Hanks & Small in N. Am. Fl. xxv. 16 (1907), Fl. Rocky Mts. 533 (1917).—Uplands of Colorado and Utah.—TYPE LOCALITY: Aquarius Plateau, at the head of Poison Creek, Utah. Specimens examined: UTAH: Aquarius Plateau, *L. F. Ward*, Aug. 11, 1875 (G), *Rydberg & Carlton* 7401 (NY, TYPE; G), 7408, 7411, 7415, 7446 (NY); Milford, *F. W. Hill* 154 (UI).

This species occupies a position between *G. caespitosum* and *G. Fremontii*. The glandless indument is like that of the former; the shorter stylodia, and the small amount of pubescence on the petals place it near *G. Fremontii*.

12. *G. COWENII* Rydb. Perennial with a branched, woody caudex; stems few, tufted, erect, 20–40 cm. tall, the lower internode shortly villous with non-glandular, whitish, somewhat retrorse trichomes about 1 mm. long; petioles of the basal leaves 7–17 cm. long, loosely villosulous with whitish non-glandular trichomes; blades thickish, pentagonal or roundish in outline, 3–6 cm. broad, strigillose on both surfaces, deeply 5-parted, the

divisions rhombic-obovate, deeply 3-5-lobed, the lobes acute; basal sinus acutish; stipules lanceolate, attenuate, villosulous, non-glandular, 5-10 mm. long; cauline leaves similar to the basal ones, smaller, shorter-petioled or sessile; inflorescence terminal, the peduncles erect, 5-15 cm. long, sparsely pilosulous, each 2-3-flowered; pedicels more or less pilosulous with non-glandular trichomes, sometimes slightly glandular in the bud stage, 3-5 cm. long, becoming reflexed and bent upward in fruit; sepals 8-11 mm. long, oval-lanceolate, acutish, narrowly hyaline-margined, puberulent, not at all glandular; mucro 1-2 mm. long; petals lavender to pale rose-purple, obovate to broadly obovate, 1.5-2 cm. long, pilose inside about one-third their length; filaments ciliolate about one-third their length; mature stylar column 2-2.5 cm. long, rather closely short-hispidulous, scarcely glandular; stylodia 5-7 mm. long; carpel-bodies ellipsoid, 5 mm. long, pubescent; seeds reticulate.—Fl. Colorado, Bull. 100, Colorado Agr. Exp. Sta. 218 (1906); Hanks & Small in N. Am. Fl. xxv. 16 (1907); Knuth in Engler, Pflanzenr. iv (129). 103 (1912); Rydberg, Fl. Rocky Mts., 532 (1917).—Canyons and mountainsides, Colorado. TYPE LOCALITY: Rist Canyon, Colorado. Specimens examined: COLORADO: Horsetooth Gulch, C. S. Crandall, July 15, 1897 (NY); Turkey Creek, Rydberg & Vreeland 5917 (NY); Placer Gulch, Rydberg & Vreeland 6639 (NY); Rist Canyon, W. F. Marshall 1157 (NY, TYPE).

Geranium Cowenii, which is apparently endemic to Colorado, is evidently a member of the "caespitosum" group, and is probably nearly related to *G. marginale*. From *G. Fremontii* it is effectively separated by its somewhat larger flowers, longer stylodia, and non-glandular pubescence.

13. *G. PARRYI* (Engelm.) Heller. Perennial with branched caudex; stems 10-40 cm. tall, tufted, erect, the lower internode and the petioles of the basal leaves, more or less glandular-pilose or glandular-puberulent, with some longer, scattered, whitish, spreading, non-glandular trichomes; petioles of the basal leaves 8-20 cm. long; blades thickish, 2-7 cm. broad, strigose on both surfaces, especially on the veins, reniform to pentagonal in outline, deeply 3-7-parted, the divisions incised to lobed, the lobes rhombic, usually 3-parted; margins glandular-ciliate; basal sinus broad, often truncate; cauline leaves similar, smaller; stipules lanceolate, 7-12 mm. long, glandular-puberulent to glandular-villosulous; inflorescence spreading-cymose; peduncles 2-8 cm. long, axillary or terminal, glandular-villosulous with trichomes 1-1.5 mm. long; pedicels usually paired, sometimes in threes, 1.5-5 cm. long, becoming reflexed and bent upward in fruit, rather copiously glandular-villosulous, the straight, spreading

trichomes 0.5–1 mm. long, tipped with yellowish or translucent glands, and often with an inconspicuous underlying pubescence of short, curved, whitish, non-glandular trichomes; sepals 6–10 mm. long, oval, glandular-villosulous, the mucro 0.5–1.5 mm. long; petals emarginate, 1.2–1.5 cm. long, pale to deep rose-purple, pilose about one-fourth their length; mature stylar column 1.5–3 cm. long, densely glandular-pubescent; stylodia 5–6 mm. long; carpel-bodies 4–5 mm. long, hispid with trichomes 1–2 mm. long; seeds 3–3.5 mm. long, reticulate.—Cat. N. Am. Pl. ed. 2. 7 (1900); Hanks & Small in N. Am. Fl. xxv. 14 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129) 100 (1912); Rydberg, Fl. Rocky Mts. 532 (1917). *Geranium Fremontii* var. *Parryi* Engelm. in Am. Journ. Sci. ser. 2. xxxiii. 45 (1862). *Geranium Richardsonii* var. *intermedia* O. Kuntze, Rev. Gen. Pl. i. 93. 1891. *Geranium Pattersonii* Rydberg, Bull. Torr. Bot. Club, xxix. 242 (1902); Hanks & Small in N. Am. Fl. xxv. 14 (1907); Knuth in Engler, Pflanzenr. iv (129). 100 (1912); Rydberg, Fl. Rocky Mts. 532 (1917). *Geranium Fremontii Parryi* Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941).—Not uncommon on gravelly slopes or in rocky soil, on mountainsides, in canyons, or foothills, at altitudes of 7000 to 10,000 feet, southern Wyoming, Colorado, Utah, and Arizona. TYPE LOCALITY: "From the headwaters of Clear Creek, and the alpine ridges lying east of 'Middle Park', Colorado Territory." TYPE collected in 1861 by C. C. Parry. Specimens examined: WYOMING: Jelm, Albany Co., Aven Nelson 8061 (G, NY). COLORADO: Colorado Springs, M. E. Jones 150 (NY); Broadmoor, A. Isabel Mulford, Sept. 1, 1892 (NY); Pike's Peak, T. F. Allen in 1894 (NY); Manitou, F. Clements 187 (NY); Idaho Springs, C. L. Shear 3282 (NY); Rollinsville, L. O. Overholtz, July 8, 1913 (NY); Watertown, Douglas Co., Osterhout & Clokey 4196 (NY, F, UC); Gray's Peak, P. A. Rydberg, Aug. 23, 1895 (NY, type of *G. Pattersonii* Rydb.); North Cheyenne Canyon, near Pike's Peak, E. A. Bessey, July 14, 1896 (NY); foot of Pike's Peak, C. L. Shear 3702 (NY); Ute Pass, C. L. Shear 3696 (NY); Eldora to Baltimore, Gilpin Co., F. Tweedy 5537 (NY); no definite locality, Herb. Otto Kuntze 3024 (NY); Buffalo Creek Canyon, H. H. Rusby, Sept. 14, 1909 (NY); near Empire, H. N. Patterson 176, 177, (NY, G, F, UC); headwaters of Clear Creek east of Middle Park, C. C. Parry 113 (TYPE, NY; G); Artist's Glen. Pike's Peak, H. M. Hall 10927 (UC, G); Brookvale, Clear Creek Co., J. R. Churchill, June 19, 1918 (G); mts. of Colorado, W. M. Canby, Aug. 1871 (G); Larkspur, Arapahoe Co., R. C. Rollins 1194 (UI, G); Crescent, Gilpin Co., H. M. Hall 10425 (UC); Sierra Mojado, T. S. Brandegee, June 22, 1877 (UC); Trails End, Aven Nelson 10112 (UC). UTAH: near Mirror Lake, Kane Co., W. S.

Boyle Z375 (UC). ARIZONA: Clark's Valley, *H. H. Rusby*, Aug. 4, 1883 (NY); Trumbull, *E. Palmer 68* (G).

This species has an obvious affinity with *G. Fremontii* and by some authors has been regarded as a variety of it. It may be distinguished at once from *G. Fremontii* by the glandular-villous indument of the stem and petioles, while the stem and petioles of *G. Fremontii* are short-pubescent, with non-glandular trichomes.

We are reducing *G. Pattersonii* to synonymy under this species because it occupies the same geographical range and habitat, and we can find no reliable taxonomic characters to distinguish it. The leaf-characters used originally to separate *G. Pattersonii* from *G. Parryi* are intangible and inconstant. However, it may be worth noting that the pubescence of the petioles of the basal leaves, and the lower internode of the stems of some of the specimens determined by Rydberg as *G. Pattersonii* is somewhat less glandular than in most specimens of *G. Parryi*.

14. *G. FREMONTII* Torr. ex Gray. Perennial with branched caudex; stems 20–50 cm. tall, tufted, erect at first, later decumbent and divaricately branched, the lower internode sparsely retrorsely strigose to nearly glabrous; petioles of the basal leaves 7–30 cm. long, finely retrorsely pubescent with whitish, glandless trichomes; blades 3–8 cm. broad, reniform to pentagonal, 5–7-parted, the lobes oblong, acute, strongly veined, sparsely appressed-pubescent on both surfaces, or sometimes glandular below; cauline leaves similar, smaller, the petioles glandular-pubescent, as are frequently the uppermost leaves; blades 2–5 cm. broad, 3–5-parted; stipules lanceolate, 5–7 mm. long, puberulent, more or less glandular, ciliate; inflorescence axillary or terminal; peduncles 1.5–3 cm. long; pedicels in pairs (rarely more than 2), usually 2–3 cm. long, rather densely glandular-villosulous, the trichomes short, spreading, yellowish-tipped; sepals 7–12 mm. long, oval-lanceolate, the mucro 1 mm. long, the outer ones glandular; petals 1–1.5 cm. long, obovate, emarginate, pale purple, dark-veined, rarely white, pilose about one-fourth their length; filaments ciliate one-fourth their length; mature stylar column about 3 cm. long, densely glandular-pubescent; stylodia 4–5 mm. long; carpel-bodies 5 mm. long, sparingly pubescent or hispid, at least along the keel, the trichomes about 1 mm. long; seeds 3–4 mm. long, reticulate.—In *Pl. Fendler*. [Mem. Am. Acad. ser. 2. iv.] 26 (1849); Engelmann in Gray, op. cit., 27 (1849); Trelease in Mem. Boston Soc. Nat. Hist. iv. 75 (1888), and in Gray, *Syn. Fl.* i. 359 (1897); Howell,

Fl. Nw. Am. 106 (1897); Hanks & Small, N. Am. Fl. xxv. 15 (1907); Coulter & Nelson, New Man. Rocky Mt. Bot. 303 (1909); Knuth in Engler, Pflanzenr. iv (129). 101 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 381 (1915); Rydberg, Fl. Rocky Mts., 532 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 338 (1925); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). *Geranium furcatum* sensu Hanks in Hanks & Small, N. Am. Fl. xxv. 16 (1907); Knuth in Engler, Pflanzenr. iv (129). 104 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 381 (1915). Non Kit. in Linnaea, xxxii. 567 (1863), nec Schur, Enum. Pl. Transs. 138 (1866). *Geranium caespitosum* sensu Hanks & Small, in N. Am. Fl. xxv. 15 (1907); Rydberg, Fl. Rocky Mts., 532 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925). Non Gray (1849). *Geranium caespitosum gracile* Nels. & Macbride, Bot. Gaz. lv. 376 (1913); *Geranium atropurpureum* var. *furcatum* Kearney & Peebles, Journ. Washington Acad. Sci. xxix. 485 (1939).—Canyons, plains, and foothills, 5000–10000 feet altitude, in Wyoming, Colorado, New Mexico and Arizona. TYPE LOCALITY: “Bottom lands of the Mora River, among shrubs; August. (Also in the Raton Mountains, Lieut. Abert, and probably farther north and west by Col. Fremont.)” Representative specimens: WYOMING: Camp Crawford, Mrs. Joseph Clemens, Aug. 6, 1908 (G, F); Chug Creek, Albany Co., Aven Nelson 7330 (NY, G, UI); Albany, W. G. Solheim 242 (UI); Laramie, B. C. Buffum, June 1892 (UI). UTAH: Willow Springs, E. H. Graham 9563 (G); Bryce Canyon, W. S. Boyle Z392 (UC); Panguitch Lake, Goodman & Hitchcock 1587 (NY, US, F, G, UC). COLORADO: Sangre de Christo Creek, Rydberg & Vreeland 5916 (NY); Sand Creek Pass, C. F. Baker, Aug. 3, 1897 (NY); Fort Collins, C. S. Crandall, July 15, 1897 (NY), Mildred E. Mathias 363 (NY), G. E. Osterhout 6315 (G), C. F. Baker, May 24, 1896 (NY); Wooton, H. H. Rusby, Sept. 11, 1909 (NY); Gunnison, R. C. Rollins 1333 (NY, UI); Twin Lakes, I. W. Clokey 3584 (NY, G, UI, UC); Allenspark, Johnston & Hedgecock 724 (NY); Thompson Canyon, E. L. Johnston 704 (NY); Boulder, F. Tweedy 5017 (NY); Sheep Canyon, F. E. & Edith S. Clements 90 (NY, G); Larimer Co., J. H. Cowen 99 (UC, NY), 112 (G), G. E. Osterhout 6312 (UC, G); Estes Park, Mrs. R. L. Russell in 1916 (G); La Veta, C. S. Crandall, Aug. 21, 1897 (NY); Gould Creek, Pike’s Peak Forest Reserve, J. C. Blumer, Aug. 12, 1903 (G, F); North Elk Canyon, Rio Blanco Co., W. C. Sturgis, July 21, 1902 (G); Low Mts., n. Colorado, Asa Gray in 1872 (G); Como, Miss E. L. Hughes 47, 48 (G); Estes Park, M. S. Baker 4515b (UC). NEW MEXICO: Ceballa, E. O. Wooton 2875 (NY); Pinos Altos Mts., E. L. Greene, Aug. 23, 1880 (F); without definite locality, Frémont 42 (NY, G); Raton Mts., Abert, Aug. 7, 1846 (NY, TYPE; G). ARIZONA:

Flagstaff, C. A. Purpus 8096 (UC); Bekins Butte, J. W. Toumey, July 19, 1892 (UC); White Mts., L. N. Goodding 655 (NY); San Francisco Mt., C. B. Wolf 3165 (G); Grand Canyon of the Colorado, T. F. Allen, Aug. 1897 (NY, type of *G. furcatum* Hanks; UC).

Geranium Fremontii is a characteristic plant of hillsides and canyons of the southern Rocky Mountain region. It has been named by several authors *G. caespitosum*, but as shown in the discussion in this paper, following the description of *G. caespitosum* James, this is, of course, quite erroneous. *G. Fremontii* is much closer to *G. Parryi* than it is to *G. caespitosum*.

Geranium furcatum Hanks, described from specimens collected in the Grand Canyon of the Colorado, is evidently identical with *G. Fremontii*, and is therefore herein reduced to synonymy.

15. *G. EREMOPHILUM* Wooton & Standley. Perennial with a slender, branched caudex; stems tufted, slender, weak, divaricately branching, suberect or decumbent, 40–70 cm. long, finely retrorsely pubescent; petioles of the basal leaves 4–6 cm. long, finely retrorsely pubescent, the blades 2.5–4 cm. broad, pentagonal in outline, obtuse or truncate at the base, 3- or 5-lobed, the lobes rhombic, 3-toothed, acute, finely appressed-pubescent; cauline leaves smaller, thin, 3-lobed, generally halberd-shaped, sparingly appressed-pubescent above, the lower surface similar except for more or less retrorse pubescence on the veins; stipules attenuate-lanceolate, 2–10 mm. long, puberulent, ciliate; peduncles axillary, slender, 3–15 cm. long; pedicels paired, finely retrorsely pubescent and sometimes somewhat glandular, 1.5–3 cm. long; sepals 8–10 mm. long, oval-lanceolate, appressed-pubescent, not glandular, the mucro 1–2 mm. long; petals purplish pink, 1–1.5 cm. long, obovate, retuse, sometimes paler, pilose about half their length; mature stylar column 2.5–3 cm. long, appressed-pubescent or glandular-pubescent; stylodia 6–7 mm. long; carpel-bodies 4–5 mm. long, sparingly short-strigose; seeds about 3 mm. long, reticulate.—Wooton & Standley in Contr. U. S. Nat. Herb. xvi. 142 (1913).—Mountains of New Mexico and Arizona. TYPE LOCALITY: San Luis Mountains, New Mexico. Specimens examined: NEW MEXICO: San Luis Mts., E. A. Mearns 2142 (US, TYPE), 2194 (US); Redstone, A. Isabel Mulford 859 (NY); Fort Bayard Watershed, Grant Co., J. C. Blumer 29 (NY, G); Hot Springs, F. H. Snow (UC); Mogollon Mts., Socorro Co., O. B. Metcalfe 242 (NY); Organ Mts., Dona Ana Co., Wooton & Standley, Sept. 23, 1906 (US). ARIZONA: Luka-Chukai Mts., Apache Co., Goodman & Lois B. Payson 2785 (NY); White Mts., L. N. Goodding 1248 (NY); Flagstaff, H. C. Hanson A 194 (UI); Barnhart Pass, Matzatzal

Mts., Gila Co., *Rose E. Collom* 111 (NY); Chiricahua Mts., *J. W. Toumey* (G); Rincon Mts., *J. C. Blumer* 3305 (UC); Huachuca Mts., *L. N. Goodding* 356 (NY), *E. A. Mearns* 2601 (US); Apache Pass, *J. G. Lemmon* 524 (G).

This species is most closely related to *G. caespitosum*, from which it differs in having more or less glandular indument, at least on the pedicels. In discussing the relationship of *G. eremophilum* with its near allies, Wootton & Standley say “. . . near *G. Fremontii* and *G. caespitosum*, but is more slender, has paler, rather larger flowers, scarcely any glandular pubescence, and nearly glabrous leaves with broader, blunter segments.” This analysis is amply supported by a close study of the holotype and abundant additional specimens from Arizona and New Mexico.

16. *G. CAESPITOSUM* James. Perennial with a woody, usually branched caudex; stems tufted, erect at first, later becoming procumbent or ascending, divaricately branched, and frequently rooting at the nodes, 10–90 cm. long, strigillose to pilosulous with glandless trichomes above, often rather copiously short-villous near base; petioles of the basal leaves 8–12 cm. long, pubescent; blades 2–5 cm. broad, orbicular to pentagonal in outline, finely appressed-pubescent on both surfaces, 5-parted, the lobes rhombic, each 3-parted; basal sinus broad, open; cauline leaves similar, 1–5 cm. broad, 3–5-parted, the 3-divided lobes divaricate, acute; stipules linear-lanceolate, acuminate, 2–10 mm. long, puberulent and ciliate; peduncles solitary, axillary, slender, pilosulous, 4–15 cm. long; pedicels paired, 2–3 cm. long, becoming reflexed in fruit, retrorsely pilosulous or puberulent with non-glandular trichomes; sepals 8–12 mm. long, oval, 3-veined, acute or obtuse, hyaline-margined, ciliate and sparsely appressed-pubescent, non-glandular; mucro 1–2 mm. long; petals 12–18 mm. long, obovate, deep rose-purple, sometimes paler, pilose inside about half their length; mature stylar column 2.5–3 cm. long, sparsely puberulent; stylodia 5–8 mm. long; carpel-bodies 4–5 mm. long, sparsely short-strigose, with an underlying puberulence; seeds 3–4 mm. long, reticulate.—James apud Gray, *Plantae Fendl.* [Mem. Am. Acad. ser. 2. iv.] 25 (1849); James in Long's Exped. Rocky Mts. ii. 3 (1823), as “*G. caespitose*”; Torr. in Ann. Lyceum Nat. Hist. New York, ii. 173 (1828); Torr. & Gray, *Fl. N. Am.* i. 207 (1838); Walpers, *Rep. Bot. Syst.* i. 450 (1842); Engelm. in Gray, *Mem. Am. Acad. ser. 2, iv.* 27 (1849), in *Plantae Wright.* ii. 25 (1852); Trelease in *Mem. Boston Soc. Nat. Hist.* iv. 75 (1888), and in Gray, *Syn. Fl.* i. 359 (1897); Coulter & Nelson, *New Man. Rocky Mt. Bot.* 303 (1909); Knuth in Engler, *Pflanzenr.* iv (129). 102 (1912). *Geranium gracile* sensu Engelm. in Gray, *Mem. Am. Acad. n. s. iv.* 27

(1849); Hanks & Small in N. Am. Fl. xxv. 16 (1907); Tidestrom & Kittell, Fl. Arizona & New Mexico, 131 (1941). Non Ledeb. ex Nordm. in Bull. Sc. Acad. St. Petersb. ii. 314 (1837), nec Schrenk in Bull. Phys. Math. Acad. St. Petersb. iii. 308 (1845). *Geranium caespitosum* f. *albiflorum* Cockerell, Science Gossip, xxv. 188 (1899). *Geranium atropurpureum* Heller, Bull. Torr. Club, xxv. 195 (1898); Knuth in Engler, Pflanzenr. iv (129). 103 (1912); Wooton & Standley, Contr. U. S. Nat. Herb. xix. 380 (1915); Rydberg, Fl. Rocky Mts. 533 (1917); Tidestrom, Contr. U. S. Nat. Herb. xxv. 337 (1925).—Hillsides, canyons, or open woods, Colorado and western Texas to New Mexico, Arizona, and Utah; Mexico. TYPE LOCALITY: "Santa Fé Creek, near irrigating ditches, at the foot of mountains; May to July; and six miles east of the Mora River; August."—Representative specimens: COLORADO: Norwood Hill, San Miguel Co., *E. P. Walker* 407 (NY, G); Artist's Glen, Minnehaha, *J. Arthur Harris* C21409 (NY); Beaver Creek Reservoir, Rio Grande Co., *R. C. Rollins* 1491 (NY, G, UI); Rio Blanco Creek, Archuleta Co., *R. C. Rollins* 1543 (NY, G, UI); Ouray, *Underwood & Selby* 152, 152a (NY), *C. F. Baker* 763 (NY, G); Arboles, *C. F. Baker* 448 (NY, F, G); Paradox, Montrose Co., *E. P. Walker* 217 (G); Pagosa Springs, *Susan Delano McKelvey* 4716 (G); Dolores, Montezuma Co., *C. S. Crandall* 111 (G); Pueblo, *R. W. Woodward*, June 1883 (G); Horsefly Creek, Montrose Co., *E. B. & Lois B. Payson* 3908 (G, UC); Mancos, *Baker, Earl & Tracy* 407 (F, NY, G, UC). TEXAS: McKittrick Canyon, Guadalupe Mts., Culberson Co., *Moore & Steyermark* 3486 (NY, UC, G); Limpia Canyon, *G. C. Nealley* 65 (F); Livermore Peak, Davis Mts., Jeff Davis Co., *Ferris & Duncan* 2550 (NY), *E. J. Palmer* 30730A, 34371 (NY), *Mary S. Young*, September 10, 1918 (G, UC, UI). NEW MEXICO: Santa Fé, *A. A. & E. Gertrude Heller* 3723 (NY, G, UI, type collection of *G. atropurpureum* Heller), *F. S. Earle* 81 (NY); Fort Bayard, *A. Isabel Mulford* 358 (NY, UI); Pinos Altos Mts., *A. Isabel Mulford* 760 (NY, UI); Whitman's Camp, *A. Isabel Mulford* 1243 (NY, UI); Cloudcroft, Sacramento Mts., Otero Co., *E. O. Wooton* 6753 (NY, G); Wheeler's Ranch, *E. O. Wooton*, July 11, 1906 (NY); White Mountain Peak, *E. O. Wooton*, July 6, 1895 (NY); Bartlett Ranch, *E. O. Wooton*, Sept. 3, 1913 (NY); White Mountains, Lincoln Co., *E. O. Wooton* 218 (NY, UC, UI); Burro Mts., *J. C. Blumer* 1835 (NY, F, G), Grant Co., *O. B. Metcalfe* 194 (NY, G, UI, UC); Copper Mines, *Thurber* 229 (NY, G); Las Vegas Hot Springs, *T. D. A. Cockerell* 58 (NY); Pecos River National Forest, *P. C. Standley* 4117 (NY, G); Ute Park, Colfax Co., *P. C. Standley* 14119 (NY); Trujillo Canyon, Gila Nat. Forest, *W. R. Chapline* 330 (NY); Balsam Park, Sandia Mountains, *Charlotte C. Ellis* 109 (NY); El Capitan Mts., *F. S. & Esther S. Earle* 201 (NY, UC); San Antonita, *J. M.*

Bigelow, Oct. 9, 1853 (NY, G); without locality, *C. Wright* 910 (NY, G); 6 mi. e. of Moro River, *A. Fendler* 89 (G, TYPE; NY, UC, F); Jemez Mts., Sandoval Co., *R. Goodwin*, Aug. 22, 1932 (G); High Rolls, Otero Co., *H. L. Viereck*, May, 1902 (G); Rociada, *J. E. Dandelin*, Aug. 1905 (G, UC); Rio Apache, *E. O. Wootton*, June 21, 1892 (UI). ARIZONA: Flagstaff, *L. F. Ward*, June 6, 1901 (NY), *D. T. MacDougal* 118 (NY, F, UC, G); Fossil Creek, *E. A. Mearns*, June 19, 1885 (NY); Pinedale, *Myrtle Zuck*, July 15, 1897 (NY); Santa Catalina, *J. A. Harris* C16392 (NY); Santa Catalina Mts., *C. G. Pringle* in 1881 (G); McNary, White Mts., *Goodman & C. L. Hitchcock* 1328 (NY, UC, G); Baboquivari Mts., *M. F. Gilman* 21 (NY); Painted Desert, Laguna Canyon, *W. N. Clute* 30 (NY, G, UI); Huachuca Mts., *L. N. Goodding* 776 (NY, G), *Lemmon* 2652 (G); Rincon Mts., *J. C. Blumer* 3305 (F, G); Coconino Nat. Forest, *G. A. Pearson* 298 (G); Mingus Mt., *W. W. Jones* 283 (G, UC). UTAH: Between Moab and Monticello, *Rydberg & Garrett* 9107 (NY); Monticello, *Rydberg & Garrett* 9163 (NY).

Because the publication in 1823 of this specific name by Dr. Edwin James was ambiguous, and since he had collected no specimen, the exact identity of James' plant is uncertain. All that James said about it is as follows: "*G. caespitose*, sub-erect, pubescent, sparingly branched above. Radical leaves reniform deeply 5-7-cleft. The flower is a little larger than that of *G. robertianum*, and similarly coloured, having whitish lines towards the base of the corolla." When, in 1849 Gray described a species of geranium from the Rocky Mountains, he said, ". . . I am so confident that it is the species noticed and imperfectly characterized by Dr. James, that I venture to revive his name, which, unless thus identified, must ever remain appended to the genus as a doubtful species, since no specimens of it exist in the collections made by him in Long's Expedition." By this statement, and through the description of the species and the designation of a type locality, Dr. Gray appears to have securely established the entity *G. caespitosum* upon a firm and durable taxonomic foundation. Supporting evidence is supplied by a sheet in the Gray Herbarium, labeled *Plantae Novo-Mexicanae*, 6 miles east of Moro River, 18 Aug. 1847, *A. Fendler* 89, inscribed by Dr. Gray: "*G. caespitosum* James." Duplicate specimens are in the herbaria of the New York Botanical Garden and the University of California. However, dissenting opinion has been expressed by Trelease (1888) who makes this comment: "There is reason

to doubt whether James' plant was not really the preceding [i. e., *G. Fremontii*], for he did not collect south of Pike's Peak, while this species, as I understand it, is distinctively southern." It should be noted, however, that *G. caespitosum* ranges from New Mexico northward to Colorado and hence may occur in the region explored by James. A. A. Heller (1898) likewise expressed doubt as to the possibility that Gray's *G. caespitosum* could have been the plant observed in 1823 by James. The whole matter now appears to be rather inconsequential, because whatever may have been the identity of the plant observed by James, the fact remains that the name *G. caespitosum* was validated when Asa Gray gave it a proper description. It seems desirable therefore, to abide by Dr. Gray's interpretation. In fact, this conclusion was reached by Nelson & Macbride in 1913. They say¹: "It is somewhat singular that there should be any misunderstanding in regard to *Geranium caespitosum* James. Admitting that the original printing of the name did not publish the species, Dr. GRAY'S diagnosis in Pl. Fendl. 25 and Dr. TRELEASE'S in Bost. Soc. Nat. Hist. 4: 72 fixed the plant to which this name must apply. Specimens answering to this description are not rare in the herbaria and are always non-glandular and with the pubescence of the stem (whether sparse or abundant) more or less retrorse. The plant is always caespitose, growing in the form of a turf or mat from which short assurgent stems arise. The new characterization in the N. A. Fl. 25: 15 would seem to be without warrant, and at best that description presents merely one of the variants of *G. Fremontii* Torr."

The Fendler specimen of *G. caespitosum* named by Gray is identical with the plant later described by Heller as *G. atropurpureum*, and there are numerous additional specimens from Arizona, Colorado, and New Mexico to match it.

Hanks & Small, and later Rydberg, applied the name *G. caespitosum* to a coarser, glandular-pubescent plant, which they attempted to segregate from *G. Fremontii* because of slight differences in foliar characters; but we now know that *G. caespitosum* sensu Hanks & Small is synonymous with *G. Fremontii*. Hanks & Small, as well as Rydberg, applied the name *G. atropurpureum* Heller to the slender non-glandular plant which is the true *G. caespitosum*.

¹ Nelson, A., & Macbride, J. Francis, Bot. Gaz. Iv. 376 (1913).

Examination of a series of specimens shows that plants with pale petals often occur in this species, as well as the apparently more common deep purple-flowered form described by Heller as *G. atropurpureum*. The varying amounts of anthocyanin pigment in the petals are correlated, in all probability, with the metabolism of the plant. Hanks & Small (1907) called this species *G. gracile* Engelm.; but this name is untenable because it was previously used by Ledebour in 1837, and again by Schrenk in 1845.

17. *G. LENTUM* Wooton & Standley. Perennial, with a stout caudex; stems 20–60 cm. tall, slender, ascending or spreading, copiously glandular-pilose; petioles of the basal leaves 7–13 cm. long, glandular-pilose; blades 3–5 cm. broad, roundish in outline, 5-parted, the divisions rhombic to obovate, and with obtuse tips, densely hispidulous-strigose or glandular-villosulous on both surfaces; cauline leaves similar, 2–5 cm. broad; stipules lanceolate, attenuate, 3–7 mm. long, pilose; inflorescence axillary and terminal, cymose; peduncles 2–7 cm. long, densely glandular-villosulous; pedicels paired, 1–4 cm. long, densely glandular-villosulous; sepals oval, 7–8 mm. long, the outer ones glandular-pilose; mucro 0.5–1 mm. long; petals 8–10 mm. long, white, entire or emarginate, sparsely pilose about half their length; filaments ciliolate half their length; mature stylar column 2–2.5 cm. long, glandular-pubescent; stylodia 4–5 mm. long; carpel-bodies about 4 mm. long, puberulent and sparsely hispid; seeds 2.5–3 mm. long, finely reticulate.—In Contr. U. S. Nat. Herb. xvi. 142 (1913); Tidestrom & Kittell, Fl. Ariz. & New Mex., 131 (1941), ex p.—Mountains of Arizona, New Mexico, and adjacent Texas; Mexico. TYPE LOCALITY: West Fork of the Gila River, Mogollon Mts., Socorro Co., New Mexico. Specimens examined: ARIZONA: Johnsons Basin, *E. O. Wooton*, June 22, 1892 (UI). NEW MEXICO: West Fork of Gila, Mogollon Mts., *E. O. Wooton*, Aug. 7, 1900 (US, TYPE); Tortugas Mt., southeast of Las Cruces, Dona Ana Co., *E. O. Wooton*, Oct. 6, 1904 (US); Middle Fork of the Gila, Mogollon Mts., Socorro Co., *E. O. Wooton*, Aug. 5, 1900 (US); Rio Zuni, *E. O. Wooton*, July 28, 1892 (US); Craters, Valencia Co., *E. O. Wooton*, July 28, 1906 (US); Pinos Altos Mts., *E. L. Greene*, September 1880 (F). TEXAS: Chisos Mts., *C. H. Mueller* 8050 (F).

Tidestrom & Kittell (1941) have placed the name *G. lentum* in synonymy under *G. Wislizeni*; however, we regard *G. lentum* as a distinct species, growing in New Mexico and Arizona, and probably also in Mexico, although we have seen no specimens of it from the region south of the Rio Grande. *G. lentum* is easily recognized by its densely glandular-villous indument on the

stems and leaves. It is readily separated from *G. Wislizeni* by its heavy indument, larger sepals and carpel-bodies, as well as the longer styler columns and stylodia.

Geranium lentum may be more closely allied to the Section *Caespitosa* than to the Section *Mexicana*, and except for a more diffuse habit of growth, the solitary peduncles, white flowers, and more southern geographical range, it might be mistaken for *G. Parryi*, of the Colorado uplands, which has an erect habit, and lavender flowers.

18. *G. WISLIZENI* S. Wats. Perennial, the caudex usually simple; stems 20–40 cm. tall, often tufted, erect, retrorsely villosulous, not glandular, petioles of basal leaves 15–30 cm. long, villosulous; blades 2–8 cm. broad, pentagonal in outline, 5-parted, the rhombic lobes several times incised, the segments obtuse or rounded, sparsely strigose on both surfaces; basal sinus broad, obtuse; cauline leaves 3–5-parted, similar to the basal ones; stipules lanceolate, 3–7 mm. long, puberulent, ciliate; inflorescence spreading-cymose, the peduncles 1.5–6 cm. long; these, as well as the pedicels, pilose and more or less glandular; pedicels 0.5–2 cm. long, paired, spreading and reflexed in fruit; sepals 5–7 mm. long, oval, puberulent and sparsely hispidulous, the mucro 1–1.5 mm. long; petals 7–10 mm. long, entire, white, pilose one-third to one-half their length; filaments ciliate about three quarters their length; mature styler column 1.4–1.8 cm. long, puberulent, more or less glandular; stylodia 2–3 mm. long; carpel-bodies 2–2.5 mm. long; mature seeds not seen.—*Proc. Am. Acad.* xxi. 421 (1886); Hanks & Small, *N. Am. Fl.* xxv. 11 (1907); Knuth in Engler, *Pflanzenr.* iv (129). 198 (1912); Tidestrom & Kittell, *Fl. Ariz. & New Mex.* 131 (1941), ex p.—Northern Mexico, Arizona, Texas.—TYPE LOCALITY: Norogachi, Mexico. ARIZONA: Sycamore Canyon, near Ruby, Santa Cruz Co., Kearney & Peebles 14434 (US); Huachuca Mts., Peebles, Harrison & Kearney 3506 (US), L. N. Goodding 729 (NY, G, US), M. E. Jones 24983 (G, NY), J. G. Lemmon 2651 (G). TEXAS: Mt. Livermore, L. C. Hinckley 404 (F).

This Mexican species extends northward into Arizona, and is represented in herbaria by a number of collections from the Huachuca Mountains. We have not attempted to study the type of *G. Wislizeni* which is in the Gray Herbarium but are using the interpretation made by T. H. Kearney who has written the following annotation attached to a sheet of Peebles, Harrison & Kearney 3506 (US). “*Geranium Wislizeni* Wats. #3506 corresponds well with the type in Gray Herb. (*Wislizenus* #211)

although Small in N. Am. Fl. does not give *Wislizeni* as occurring in U. S. Is probably the same plant referred by Trelease in Syn. Fl. N. Am. to *G. mexicanum* HBK. and stated to have been collected by Lemmon in the Huachuca Mts. True *mexicanum* appears, however, to be annual or at most biennial, and probably does not reach the U. S. Flowering specimens desired. T. H. K." As far as we know, no specimens of *G. mexicanum* have been collected in the United States.

Geranium Wislizeni is clearly distinguishable from *G. lentum* by its smaller and more delicate, cymose inflorescence, small sepals, and shorter styler columns; also by the general lack of glandularity on the stems and leaves.

DEPARTMENT OF BOTANY,
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REDISCOVERY OF *CALTHA NATANS* IN MINNESOTA

OLGA LAKELA

A HITHERTO unknown station of *Caltha natans* Pall. in Minnesota was discovered by the writer on August 4, 1942, at Deep Lake, Sparta. It is situated at the mouth of the inlet creek of Deep Lake. A recent sinking of the water level of the lake caused by a reclamation of a water-filled mine at Gilbert, 1.5 miles distant, left the creek bed nearly dry and about fifteen feet above the present shore line. The plants in the surviving colony were found growing in the eroding sand of the creek bed, creeping toward moisture. Among the larger plants in flower and fruit were young seedlings. Some of the seedlings were also observed on the lake shore, among those of *Alisma*, *Bidens* and *Sagittaria* spp. Obviously the seedlings had developed from germination of seeds washed down in the sediment from the colony established in the creek bed.

C. natans was first known in Minnesota about fifty years ago. The earliest collection was made by E. J. Hill at Tower on August 21, 1889. Two years later J. H. Sandberg encountered the species at "Vermillion". The place name on Dr. Sandberg's collections obviously refers to Lake Vermilion. Due to insuffi-